

## Zoogeographical aspects of some scutacarid mites and their phoresy hosts (Acari, Heterostigmata; Hymenoptera, Aculeata)

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**Zoogeographical aspects of some scutacarid mites and their phoresy hosts (Acari, Heterostigmata; Hymenoptera, Aculeata).** - The known distribution of the scutacarid species *Imparipes (Imparipes) apicola* (Banks), *I. (I.) haeseleri* Ebermann & Hall and *I. (I.) breganti* Ebermann & Hall is presented. *Imparipes apicola* shows a Holarctic distribution with records from Canada, USA, Mexico and Central Europe. The area of distribution of *I. haeseleri* reaches from Central and South-eastern Europe to India. *Imparipes breganti* is known only from a number of localities in Central Europe. Females of these three mite species were found to be phoretic on solitary bees, sphecids and one eumenine wasp species, respectively; moreover, they all possess a so-called sporotheca. The distribution of these scutacarid-species with respect to the distribution of their hymenopterous hosts is discussed. A tabular list of all species of the genus *Imparipes* which were found to be phoretic on various hymenopterans (data of their distribution included) is presented.

**Keywords:** Acari - Scutacaridae - *Imparipes* - zoogeography - phoresy - wild bees - Sphecidae - sporothecae.

### INTRODUCTION

Associations of species of the scutacarid genus *Imparipes* with other arthropods have been recorded frequently (e.g. Delfinado & Baker, 1976; Eickwort, 1979, 1990, 1994; Ebermann, 1988; Ebermann & Hall, 2003). Association with hymenopterans is especially prevalent as more than 3/4 of all phoretic species of *Imparipes* can be found on Formicoidea and Apoidea. Our research is thus devoted to the relationship between the mite family Scutacaridae – especially the genus *Imparipes* – and Hymenoptera-Aculeata, mainly wild bees and sphecids, but also eumenine wasps and mutillids. Our inspection of museum and private collections for these insects with respect to phoretic scutacarid species and the investigation of microscopic slides with phoretic scutacarids from Europe, Asia and North America revealed a total of six *Imparipes* species (all phoretic females). Three of these six species, namely *Imparipes (I.) apicola* (Banks, 1914), *I. (I.) haeseleri* Ebermann & Hall, 2003 and *I. (I.) breganti* Ebermann & Hall

(2004) were found to be phoretic on wild bees, sphecids and one eumenine wasp. These mite species all possess a sporotheca that is used for the transport of fungal spores (Ebermann & Hall, 2003, 2004, 2005). A table showing the distribution of *Imparipes* species associated with bees (Apidae), digger wasps (Sphecidae) and eumenine wasps (Vespidae) with respect to the distribution of their hymenopterous hosts, is presented from our collections and already published findings.

## MATERIAL

Hymenopterous hosts and microscopic slides were studied from the following collections: CMK = Collection Michael Kuhlmann, Ahlen, Germany; ISNB = Institut Royal des Sciences Naturelles de Belgique, Brussels, Belgium; SLJG = Steiermärkisches Landesmuseum Joanneum, Graz, Austria; OÖLM = Oberösterreichisches Landesmuseum, Linz, Austria; ZMUH = Zoologisches Institut und Zoologisches Museum der Universität Hamburg, Germany.

The following abbreviations are used in this paper. *Localities*: AUT = Austria, BEL = Belgium, CAN = Canada, GER = Germany, IDA = Idaho, ITA = Italy, MAS = Massachusetts, MEX = Mexico, NEV = Nevada, NY = New York, POL = Poland, UKR = Ukraine, UT = Utah, WY = Wyoming; *Austrian provinces*: BL = Burgenland, NÖ = Lower Austria, OÖ = Upper Austria, SB = Salzburg, ST = Styria.

*Collections*: CEE = Collection Ernst Ebermann, Karl-Franzens-University Graz, Austria; CGA = Collection Gerd Alberti, Ernst-Moritz-Arndt-University Greifswald, Germany; HNHM = Hungarian Natural History Museum, Budapest, Hungary; MHNG = Muséum d'histoire naturelle, Geneva, Switzerland.

**LOCALITIES AND HYMENOPTEROUS HOSTS:** The complete list of localities of *Imparipes apicola* and *I. breganti* was published in Ebermann & Hall (2004, 2005) and is not repeated here. Due to the considerable quantity of material of *I. haeseleri* that we have at our disposal, only a part of the collecting sites and dates were already published in Ebermann & Hall (2003); the list is completed in the following. The labelling of samples refers to original labels of microscopic slides or preserved insects. With the exception of *Hylaeus angustatus* (Apidae) from POL-1 all host species mentioned in the list belong to the Sphecidae.

**AUSTRIA: AUT-BL-1:** Neustift bei Güssing, S-Burgenland; *Ectemnius dives* (Lepeletier & Brullé, 1834): ♀, 13.06.1997, Bregant leg., Gusenleitner det.; (SLJG), 12 mites. **AUT-NÖ-2:** Purgstall, garden Ressler; *Ectemnius continuus* (Fabricius, 1804): ♀, 24.06.1994, Gusenleitner leg. & det.; (OÖLM), 3 mites. **AUT-OÖ-1a:** Linz Urfaß, park; *Crossocerus annulipes* (Lepeletier & Brullé, 1834): ♂, 12.07.1999, Schwarz-Waubke leg., Schwarz det.; (OÖLM), 1 mite. **AUT-OÖ-1b:** same as AUT-OÖ-1a; *Crossocerus annulipes* (Lepeletier & Brullé, 1834): ♂, 29.07.1999, Schwarz-Waubke leg., Schwarz det.; (OÖLM), 1 mite. **AUT-OÖ-2a:** Plesching near Linz; *Crossocerus annulipes* (Lepeletier & Brullé, 1834): ♀, 09.09.1999, Schwarz leg. & det.; (OÖLM), 1 mite. **AUT-OÖ-2b:** same as AUT-OÖ-2a; *Ectemnius dives* (Lepeletier & Brullé, 1834): ♀, 25.05.1999, Schwarz leg. & det.; (OÖLM), 1 mite. **AUT-OÖ-2c:** same as AUT-OÖ-2a; *Crossocerus annulipes* (Lepeletier & Brullé, 1834): ♀, 29.08.2000, Schwarz leg., Gusenleitner det.; (OÖLM), 1 mite. **AUT-OÖ-3:** Klamleiten W Alberndorf; *Lesticia clypeata* (Schreber, 1759): ♀, 29.06.1999, Gusenleitner leg. & det.; (OÖLM), 1 mite. **AUT-OÖ-4:** Linz, Pöstlingberg, dehiscent fruit meadow; *Crossocerus annulipes* (Lepeletier & Brullé, 1834): ♀, 08.09.1999, Schwarz leg. & det.; (OÖLM), 1 mite. **AUT-SB-1a:** Salzburg,

Parsch; *Crossocerus annulipes* (Lepeletier & Brullé, 1834) ["*Crossocerus ambiguus*"]: ♂, 08.06.1963, Leclercq; (ISNB), 1 mite. **AUT-SB-1b**: same as AUT-SB-1a; *Ectemnius continuus* (Fabricius, 1804): ♀, 18.09.1963, Leclercq; (ISNB), 2 mites. **AUT-SB-1c**: same as AUT-SB-1a; *Ectemnius dives* (Lepeletier & Brullé, 1834): 1 ex., 21.07.1963, Leclercq; (ISNB), 3 mites. **AUT-ST-1a**: Graz-Messendorf, "Heimgartenanlage"; *Crossocerus annulipes* (Lepeletier & Brullé, 1834): ♀, 16.07.1994, Bregant & Klingberg leg., Gusenleitner det.; (SLJG), 1 mite. **AUT-ST-1b**: same as AUT-ST-1a; *Crossocerus annulipes* (Lepeletier & Brullé, 1834): ♀, 31.07.1994, Bregant & Klingberg leg., Gusenleitner det.; (SLJG), 1 mite. **AUT-ST-1c**: same as AUT-ST-1a; *Crossocerus annulipes* (Lepeletier & Brullé, 1834): ♀, 31.07.1994, Bregant & Klingberg leg., Gusenleitner det.; (SLJG), 3 mites. **AUT-ST-2**: Pirkwiesen W St. Marein bei Graz, E-Styria; *Crossocerus annulipes* (Lepeletier & Brullé, 1834): ♀, 31.07.1995, Bregant leg. & det.; Gusenleitner det.; (SLJG), 1 mite. **AUT-ST-3a**: Eichberg-Trautenberg S Kreuzberg, Windische Bühel, NNW Leutschach; *Crossocerus elongatulus* (v. d. Linden, 1829): ♀, 28.07.1996, Bregant leg. & det.; (SLJG), 1 mite. **AUT-ST-5**: Fladnitz im Raabtal; *Ectemnius continuus* (Fabricius, 1804): ♀, 26.08.1997, Bregant leg. & det.; (SLJG), 1 mite. **AUT-ST-6**: Griebenberg NE Paldau; *Ectemnius dives* (Lepeletier & Brullé, 1834): ♀, 03.08.2000, Gusenleitner leg. & det.; (OÖLM), 3 mites.

**BELGIUM: BEL-1a**: Riviere; *Ectemnius continuus* (Fabricius, 1804) ["*Crabro vagus*"]: 1 ex., 09.08.1933, Crevecoeur; (ISNB), 3 mites. **BEL-2**: Welkenraedt; *Ectemnius lapidarius* (Panzer, 1804): ♂, 09.06.1964, Leclercq; (ISNB), 5 mites. **BEL-3**: Wegimont; *Lestica clypeata* (Schreber, 1759) ["*Crabro clypeatus*"]: ♀, 11.08.1935, Crevecoeur; (ISNB), 2 mites.

**GERMANY: GER-1a**: National park Bayerischer Wald, "Urwald Mittelsteighütte"; *Pemphredon lugubris* (Fabricius, 1793): ♀, 20.06.-05.07.2000, Malaise, Kuhlmann leg. & det.; (CMK), 1 mite. **GER-1b**: same as GER-1a; *Ectemnius ruficornis* (Zetterstedt, 1838): ♀, 30.05.-20.06.2000, Malaise, Kuhlmann leg. & det.; (CMK), 2 mites. **GER-1c**: same as GER-1a; *Ectemnius ruficornis* (Zetterstedt, 1838): ♀, 30.05.-20.06.2000, Malaise, Kuhlmann leg. & det.; (CMK), 1 mite. **GER-1d**: same as GER-1a; *Crossocerus barbipes* (Dahlbom, 1845): ♀, 01.08.-31.08.2000, Malaise, Kuhlmann leg. & det.; (CMK), 1 mite. **GER-1e**: same as GER-1a, PF "Feistenhang"; *Mimumesa dahlbomi* (Wesmael, 1852): ♀, 07.08.-09.09.1998, Kuhlmann leg. & det.; (CMK), 3 mites. **GER-2b**: Bremen; *Crossocerus megacephalus* (Rossi, 1790): ♀, 14.07.1904, Haeseler det.; (ZMUH), 21 mites. **GER-2c**: same as GER-2b; *Crossocerus megacephalus* (Rossi, 1790): ♀, 04.08.1955, Haeseler det.; (ZMUH), 1 mite. **GER-2d**: same as GER-2b; *Ectemnius sexcinctus* (Fabricius, 1775): ♀, 06.07.1946, Haeseler det.; (ZMUH), 30 mites. **GER-2e**: same as GER-2b; *Ectemnius sexcinctus* (Fabricius, 1775): ♀, 08.07.1935, Haeseler det.; (ZMUH), 5 mites. **GER-3**: Sage near Cloppenburg; *Crossocerus cetratus* (Shuckard, 1837): ♀, 24.06.1983, Haeseler det.; (ZMUH), 2 mites. **GER-4**: Brockel, Kreis Rotenburg Wümme; *Crossocerus vagabundus* (Panzer, 1798): ♀, 06.08.1954, Haeseler det.; (ZMUH), 105 mites. **GER-5**: Sottrum bei Hildesheim; *Ectemnius continuus* (Fabricius, 1804): ♀, 23.08.1973, Haeseler det.; (ZMUH), 102 mites. **GER-6**: Krahnberg; *Ectemnius dives* (Lepeletier & Brullé, 1834): ♀, 02.08.1915, Haeseler det.; (ZMUH), 2 mites. **GER-7**: Deckbergen bei Rinteln; *Ectemnius sexcinctus* (Fabricius, 1775): ♀, 03.08.1894 Haeseler det.; (ZMUH), 1 mite. **GER-17a**: Wedel (Ki); *Pemphredon inornata* Say, 1824 ["*Pemphredon inornatus*"]: ♀, 16.07.1987, Haack det.; (ZMUH), 1 mite. **GER-17b**: same as GER-17a; *Stigmaeus solskyi* Morawitz, 1864: ♀, 16.07.1987, Haack det.; (ZMUH), 1 mite. **GER-18**: BW-Karlsruhe, Eggenstein MV53; *Ectemnius lapidarius* (Panzer, 1804): ♀, 07.08.1991, Schmid-Egger leg., Gauss det.; (CMK), 2 mites. **GER-22**: *Crossocerus vagabundus* (Panzer, 1798): 1 ex., 06.06.2002, Greifswald St. Georgsfeld, Kormmilch leg. & det.; (CGA), 19 mites.

**ITALY: ITA-1**: Sardinia; *Cerceris flavilabris* (Fabricius, 1793) ["*Cerceris ferreri*"]: ♀, 10.07.1939, Haeseler det.; (ZMUH), 1 mite.

**POLAND: POL-1**: Poland; *Hylaeus angustatus* (Schenck, 1861) ["*Prosopis curviscapus*"]: 1 ex., 1927(?), Chmielewski det.; (ZMUH), 1 mite.

**UKRAINE: UKR-1b**: Simpheropol, Crimea; *Lestica clypeata* (Schreber, 1759): ♀, 08.07.1998, Gurko leg., Gusenleitner det.; (OÖLM), 1 mite. **UKR-1c**: same as UKR-1b; *Lestica clypeata* (Schreber, 1759): ♀, 25.08.1999, Gurko leg., Gusenleitner det.; (OÖLM), 4 mites.

## RESULTS AND DISCUSSION

General information on the Palaearctic and Nearctic distribution of sphecids and wild bees in the following section is taken from Blösch (2000) and Westrich (1990).

### *Imparipes (Imparipes) apicola* (Banks)

*Material and deposition:* see Ebermann & Hall (2005).

*Distribution:* We found phoretic females of *Imparipes apicola* on 13 soil-dwelling bee species but also on three soil-dwelling sphecids. The area of distribution of *I. apicola* includes the Nearctic region of Mexico (Delfinado & Baker, 1976), wide areas of North America (Canada: Banks, 1914; USA: Cross & Bohart, 1969, 1992; Delfinado & Baker, 1976; Ebermann & Hall, 2005) and parts of Central Europe (Germany: Kuhlmann, 1998; Ebermann & Hall, 2005; Austria, Belgium, Poland: Ebermann & Hall, 2005) (Tab. 1, 2).

The geographic origin of this species is not known. Most probably the colonization of North America and/or Europe occurred in close connection with their hosts. Today all bee hosts, at least on the generic level, are inhabitants of nearctic and palaearctic regions: hosts include *Apis*, *Andrena*, *Lasioglossum* (*Dialictus*, *Evylaeus*, *Lasioglossum* s. str.), *Nomia* and *Sphecodes* (Tab. 1). Especially the latter three genera, all of them belonging to the family Halictidae, represent the preferred hosts of *I. apicola*. Halictids, in general, are also known to serve as hosts for other phoretic mite species (e.g. Fain *et al.*, 1999). A total of 24 bee host species for *I. apicola* are hitherto known, 12 of them from North America and Mexico and 12 from Europe. Apart from the honey bee (*Apis mellifera*), none of these hosts occurs on both continents (Michener *et al.*, 1994; Michener, 2000; Westrich, 1990). Only *Ectemnius continuus*, one of the three sphecids found exclusively in Europe as a host of *I. apicola* (Tab. 1), is distributed throughout the Holarctic Region. Thus, with regard to the colonization history of *I. apicola*, only the distribution of *Apis mellifera* and *Ectemnius continuus* may represent a possible link between the Old and the New World. However, *I. apicola* was found only once phoretic on a honey bee (Banks, 1914: Canada) and once on *E. continuus* (Ebermann & Hall, 2005: Europe), respectively. Especially the former record is questionable as it is very uncertain whether *A. mellifera* serves as a phoresy host for *I. apicola* at all. Since the honey bee is the best-investigated insect and no other records of this mite species have been documented within the last 90 years, we assume that in 1914 Banks has investigated a wild bee species. This could have been a species of *Andrena*, a genus which is very similar to honey bees (Westrich, 1990). Actually, *I. apicola* is quite frequently found to be phoretic on *Andrena* bees. On the other hand, with the honey bee as a phoresy host *I. apicola* could have reached the New World recently in the course of the domestication of honey bees in America.

The mechanisms resulting in the Holarctic distribution of *I. apicola* are subject to speculation. Apart from the possibility of a trans-Atlantic faunal exchange, e.g. due to a dispersal by air as it is documented for various other arthropods (e.g. Lindroth, 1957), a colonization via the Northern Bering land-bridge could have been possible. Such a faunal exchange could have taken place during the late Tertiary with its

moderate climatic conditions. Subsequent climatic changes to Subarctic conditions during the Pleistocene would have resulted in a less passable land-bridge ("filter-bridge": see Simpson, 1940, in Lindroth, 1957) for aculeate insects in general. However, mainly due to the poorly investigated aculeate and mite fauna of the Palaearctic parts of East Asia and the north-west of Alaska, empirical evidence for such an intercontinental passage are hitherto lacking.

The different ranges of hosts for *I. apicola* in America and Europe suggest a successive acceptance of local soil-dwelling hosts during colonization. Such a successive adoption of suitable new hosts is also indicated by the close relationship of these hosts and their uniform modes of nesting. Additionally, the development of sporotheca by these mites, well suited for the transport of spores of the fungi the species very probably feeds on (Ebermann & Hall, 2003), represents an increased independence from food resources in the nest of its hosts. Thus, the independence of food resources could have represented the driving evolutionary force for the search and acceptance of new hymenopterous hosts.

#### *Imparipes (Imparipes) haeseleri* Ebermann & Hall

*Material and deposition:* 481 ♀♀ from 53 localities in Austria, Italy, Belgium, Germany, Poland, Ukraine and India (Ebermann & Hall, 2003; present study). 33 of the 481 specimens were used for molecular-biological analysis: AUT-NÖ-2, AUT-OÖ-1a, AUT-OÖ-1b, AUT-OÖ-2a, AUT-OÖ-2b, AUT-OÖ-2c, AUT-OÖ-3, AUT-OÖ-4, AUT-ST-6, GER-22 (16 specimens out of 19 still exist), UKR-1a (one specimen out of 13 still exists), UKR-1b, UKR-1c. The remaining 448 slides are deposited in CEE, HNHM, ISNB, MHNG and ZMUH.

*Distribution:* Our findings originate from 18 wood-nesting sphecid species, two wild bee species and one eumenine wasp species (Tab. 1). The phoresy hosts and the phoretic mites were collected in Central and Southern Europe, respectively, and in the Ukraine, with one additional record from the Indian Peninsula (Ebermann & Hall, 2003; present study) (Tab. 1, 2). The fragmented distribution of *I. haeseleri* is obviously a result of the poor degree of sampling in these regions. By contrast, while the Nearctic and Palaearctic distribution of sphecids is relatively well documented (Blösch, 2000), the Hymenoptera-associated mites from Northern America and Asia have remained largely unknown. This lack of data becomes obvious when regarding the distribution of the 18 sphecid phoresy hosts: their distribution far exceeds the hitherto known spatial distribution of *I. haeseleri*. Seven phoresy hosts of *I. haeseleri* are also documented for North America (*Crossocerus annulipes*, *C. elongatulus*, *Ectemnius continuus*, *E. dives*, *E. lapidarius*, *E. ruficornis*, *Pemphredon inornata*) and thus show a holarctic distribution. Moreover *Ectemnius ruficornis* is also known from the Neotropical Region. Four other sphecid species are distributed as far south as Northern Africa (*Crossocerus continuus*, *C. elongatulus*, *C. megacephalus*, *Lestica clypeata*). The distribution of 16 additional species reaches the eastern Palaearctics (e.g. Mongolia, Korea, Siberia), with seven of them even recorded for Japan (*Crossocerus barbipes*, *C. cetratus*, *C. vagabundus*, *Ectemnius lapidarius*, *E. ruficornis*, *Pemphredon inornata*, *P. lugubris*). One species, *Mimumesa dahlbomi*, has extended its eastern distribution area to Sakhalin and Kamchatka. Thus, the wide distribution of the phoresy hosts of *I. haeseleri* indicates that also *I. haeseleri*, together with its hosts, may occur in Northern Africa, Central and East Asia, North America and

TAB. 1  
*Imparipes* species associated with bees (Apidae), digger wasps (Sphecidae) and eumenine wasps (Vespidae); Nearctic host species of *I. apicola* underlined.

Mite species	Hymenopterous Hosts	Regions	References
<i>Imparipes (Imparipes) americanus</i> (Banks, 1905)	Apidae: <i>Halictus venabilesii</i>	Canada	Banks, 1904 & 1906 Delfinado & Baker, 1976
<i>I. (I.) apicola</i> (Banks, 1914)	Apidae: <i>Apis mellifera</i> <i>Andrena erythrogastra</i> , " <i>extricata</i> ", <i>flavipes</i> , <i>florea</i> , <i>luppotes</i> , <i>nana</i> , <i>nigritrons</i> , <i>semilaevis</i> <i>Dialictus cressoni</i> , <i>lucyissimus</i> , <i>lineatulus</i> , <i>nympheaeorum</i> , <i>zephyrus</i> <i>Euxylaeus quebecensis</i> <i>Halictus simplex</i> <i>Lastiglossum (Dialictus) sp.</i> <i>Lastiglossum leucopus</i> , <i>lucidulum</i> , <i>semilucens</i> , <i>villosulum</i> <i>Nomia melanderi</i> <i>Sphecodes crassus</i> , <i>monilicornis</i> Sphecidae: <i>Diodontus luperus</i> <i>Ectemnius continuus</i> <i>Gorytes</i> sp.	Austria, Belgium, Canada, Germany, Mexico, Poland, USA	Banks, 1914 Cross & Bohart, 1969, 1992 Delfinado & Baker, 1976 Kuhlmann, 1998 Ebermann & Hall, 2005
<i>I. (I.) breganti</i> Ebermann & Hall, 2004	Apidae: <i>Andrena flavipes</i> <i>Hylaeus variegatus</i> <i>Osmia papaveris</i> Sphecidae: <i>Cerceris rybyensis</i> , <i>sabulosa</i> <i>Crossocerus elongatulus</i> , <i>ovalis</i> , <i>varus</i> <i>Diodontus luperus</i> , <i>iridis</i> <i>Gorytes</i> sp. <i>Lestica subterranea</i> <i>Lindenius albilabris</i> , <i>panzeri</i>	Austria, Belgium, Germany	Ebermann & Hall, 2004
<i>I. (I.) eickworti</i> Mahunka, 1969	Apidae: <i>Dialictus umbripennis</i>	Costa Rica	Mahunka, 1969

- I. (I.) floridensis*  
Delfinado & Baker, 1976
- I. (I.) haeseleri*  
Ebermann & Hall, 2003
- Apidae:** *Halictus ligatus*  
(*Augochlorella striata*)
- Apidae:** *Hylaetus angustatus*  
*Megachile lapponica*
- Sphecidae:** *Cerceris flavilabris*  
*Crossocerus annulipes*, *asward*, *barbipes*, *ceptratus*,  
*elongatulus*, *megacephalus*, *vagabundus*  
*Ectemnius continuum*, *dives*, *lapidarius*, *ruficornis*, *sexincinctus*  
*Lestica clypeata*  
*Minumesa dahlbomi*  
*Pemphredon inornata*, *lugubris*  
*Stigamus solkyi*
- Vespidae:** *Symmorphus bifasciatus*
- Apidae:** *Dialictus rohweri*
- Apidae:** *Lasioglossum (Evyllaetus) sp.*
- Apidae:** *Lasioglossum (Dialictus) sp.*
- Apidae:** *Dasyglossa plumipes*
- Apidae:** *Nomia nortoni var. plebeia*
- Apidae:** *Dialictus zephyrus*  
*Lasioglossum titus*
- Apidae:** *Halictus geminatus*
- Apidae:** *Halictus (Vestitohalictus) pollinosus thevestensis*  
*Halictus (Seladonia) joanus jucundus*
- I. (I.) illaensis*  
Delfinado & Baker, 1976
- I. (I.) mexicana*  
Delfinado & Baker, 1976
- I. (I.) neotropicus*  
Delfinado & Baker, 1976
- I. (I.) rafalskii*  
Dastyh, 1978
- I. (I.) texanus*  
(Cockerell, 1910)
- I. (I.) vulgaris*  
Delfinado & Baker, 1976
- I. (Apidacarus) apidophilus*  
Mahunka, 1974
- I. (A.) paulyi*  
Ebermann & Fain, 2002
- USA
- Austria,  
Belgium,  
Germany,  
India,  
Italy,  
Poland,  
Ukraine
- USA
- Mexico
- Chile
- Poland
- USA
- USA
- Hungary
- Algeria,  
Namibia,  
Uganda
- Delfinado & Baker, 1976
- Ebermann & Hall, 2003  
present study
- Delfinado & Baker, 1976
- Delfinado & Baker, 1976
- Delfinado & Baker, 1976
- Dastyh, 1978
- Cockerell, 1910
- Delfinado & Baker, 1976
- Mahunka, 1974
- Ebermann & Fain, 2002

possibly also in the Neotropics. Thus, carefully directed efforts might contribute to close existing gaps in the distribution of *I. haeseleri*. Consistent with this idea, a single record of *I. haeseleri* on a sphecid-species (*Crossocerus asward*) from the Oriental Region additionally supports a wider – but not yet determinable – distribution of *I. haeseleri* in the south-east of Asia.

***Imparipes (Imparipes) breganti* Ebermann & Hall**

*Material and deposition:* see Ebermann & Hall, 2004.

*Distribution:* In contrast to *Imparipes haeseleri* and *I. apicola*, *I. breganti* shows a distribution restricted to Central Europe. Mainly found on Sphecidae, *I. breganti* is only known from for Austria, Belgium and Germany (Ebermann & Hall, 2004) (Tab. 1, 2). However, the known area of distribution very likely reflects the poor status of investigation of phoretic scutacarids on sphecids. Seven of the known 10 sphecid hosts are distributed from Central Europe to West or Central Asia (*Crossocerus elongatulus*, *C. ovalis*, *C. varus*, *Diodontus luperus*, *D. tristis*, *Lindenius albilabris*, *L. panzeri*). *Crossocerus varus* has also been recorded from Japan; *Cerceris rybyensis* is known to be widely distributed in the Palaearctics, and the distribution area of *Lestica subterranea* even reaches the Ural. Furthermore, *Crossocerus elongatulus* is known from North America. Due to the distribution of already mentioned species throughout the Palaearctics or even the Holarctics, it can be assumed that *I. breganti* is more widely distributed than hitherto known, possibly also occurring outside Central Europe and possibly matching the distribution areas of its hosts.

TABLE 2

The records of *Imparipes apicola*, *I. haeseleri* and *I. breganti*. The numbers in the brackets show (1) the total number of localities and (2) the total number of collected mites in this country. ? = records of *I. apicola* in the USA published by Cross & Bohart (1969, 1992), who mentioned only federal states, but not the exact localities and numbers of mites in the hymenopteran nests.

Europe	Asia	North America
<b><i>Imparipes apicola</i></b>		
AUT (8/91)		CAN (1/8)
BEL (1/1)		MEX (1/10)
GER (8/19)		USA: IDA (?), MAS (1/8), NEV (?),
POL (1/1)		NY (11/140), WYO (?), UT (?)
<b><i>Imparipes haeseleri</i></b>		
AUT (23/65)	IND (1/1)	
BEL (4/11)		
GER (20/384)		
ITA (1/1)		
POL (1/1)		
UKR (3/18)		
<b><i>Imparipes breganti</i></b>		
AUT (16/33)		
BEL (2/3)		
GER (5/59)		



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